DISCISSION OF THE PLEURA IN THE TREATMENT OF CHRONIC EMPYEMA.

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THE prognosis and surgical treatment of purulent pleural effusions have undergone some radical changes by reason of comparatively recent bacteriological and, it might be said, operative experiments. In accordance with the bacteriological findings, the age of the patient, and the completeness of the drainage, these cases go to a speedy cure with absolute restitution to health, or run a course that is protracted in the extreme. In some cases, chiefly of tubercular origin or of grave streptococcus infection, incision practiced at the earliest practical moment and ample for drainage may yet fail to bring about that mobilization of the lung which is the one essential to a cure. On this last point I would insist chiefly for the mental relief of practitioners who, like myself, have seen acute cases assume an almost interminable course notwithstanding the early institution of drainage.

With the operation of multiple rib resections formally introduced by Estlander in 1877, to meet a condition of seemingly permanent retraction of the lung, our concept of the curability of chronic empyema was radically changed. The various modifications of thoracoplasty by Schede, Quenu Jaboulay and others served only to make the mobilization of the chest-wall less hazardous, perhaps, and the contact of the variously fashioned flap from the chest-wall with the retracted lung easier. The Estlander operation and its modifications were based on the idea of the permanent disability of lung long bound down by adhesions to expand.

In 1893 there was elucidated a new fact regarding the functional value of lung-tissue long buried in thickened pleura and fibrous adhesions. It was that the power to expand is not lost, and that if freed from its fetters the lung would again expand. Whom to credit with the discovery of this basic fact, which led to decortication of the lung in the modern operative treatment of empyema, it seems to me not difficult to determine. According to Terrier, Cornil made the observation in 1891. Before the French Surgical Congress of 1893 DeLorme reported on a case operated on by him in which he attempted the removal of the thickened visceral pleura. The patient suddenly died and the operation with pulmonary decortication was easily completed in the mortuary.

I may be permitted here to digress long enough to call attention to the frequency of sudden deaths during even the simplier empyema operations. I know of two such sudden deaths in this city. Probably the posture of the patient on the sound side during the operation has something to do with the frequency of sudden death during an operation that should *per se* be devoid of danger.

Without any knowledge of the observation of Terrier or DeLorme, Fowler, on October 7, 1893, operated on a case of empyema of two years' standing having a small rigid cavity, with a distinct intention to remove the scar-tissue from the diaphragm, pericardium and lung, with a view to permit the free expansion of the lung. Fowler having first performed the operation on the living, it is but right that priority should be given him by our continental friends. Whether it will be, is a question.

Decortication of the lung is but a step, although a very important one, in the operation for empyema. It cannot be considered an independent procedure. The cavities to be obliterated are usually so deeply placed and the pulmonary pleura so far from the surface that the formation of a large flap containing the soft parts and the ribs or multiple rib resection is necessary as a preliminary step to decortication. All attempts, therefore, to compare the results obtained from the older methods of thoracoplasty with those from decortication are futile. As performed by Fowler and DeLorme, the operation consists, after sufficient exposure of the pleura has been achieved, of an incision through the thickened pleura down to the lung-tissue, from which incision the thickened pleura is dissected off, care being taken not to wound the lung. Because of the very close adhesions and the depth at which the work has to be done, this dissection *en masse* of the thickened pleura is sometimes tedious in the extreme. DeLorme's first case required one and a-half hours to complete the operation, although the cavity was less than three inches in depth and width and four inches in height.

A perusal of the relevant case reports collected within the last five years by DeLorme, Fowler, Vosswinkel and Jordan makes it evident that in many cases insurmountable difficulties are in the way of anything like an extensive decortication. One of my first cases was of this nature and from it I learned, what other operators must certainly have observed, namely, that an incision carried through the thickened pleura until the lung-tissue is reached, as is evidenced by the bluish tint in the floor of the cut, widens out rapidly and in full view, more with each respiration until the cut becomes a groove. Whether this widening of the cut is due to the expansion of the lung or to the traction of the elastic chest-wall, or to the inherent tendency of divided scar tissue under tension to retract, I am unable to say. My belief is that the last-named cause is the most potent factor, for I have made the observation that many times the gap made by the incision grows narrower for the time being during inspiration to get wider again during expiration. This may be due to the negative pressure within the lung at the time of inspiration, by reason of the greater inrush of air through the opening in the chest-wall than can enter the lung by way of the bronchus.

Where one incision carried to the lung-tissue widens into a groove, so will a second and a third, and any number that may and can be made. Upon these principles I acted on my first case and in the rest to be reported, and devised what perhaps might be called discission of the pulmonary pleura as a modification of the operation of decortication, which I believe it may in time supplant. The special feature of the procedure consists of gridironing the pulmonary pleura with many parallel incisions removed from each other about a quarter of an inch, and of crossing these obliquely or at right angles with other parallel cuts. Little islands of thickened pleura are thus left on the surface of the expanding lung. But if the cuts have been made deep enough they shrivel in size while the discission is still in process of being completed.

A further feature towards liberating the lung is an incision cautiously carried through the length of the groove or angle of reflexion of the costal and pulmonary pleura. In large cavities the line of reflexion is, of course, not always easily found. If the incision be limited to the costal part of the gutter and carried towards the chest-wall, there is no danger of wounding large vessels or of opening the sound pleura above. The hemorrhage which attends discission is really slight and easily controlled.

CASE I.—E. M., male, aged 18, of Mitchell, Ind. First examination, June 6, 1901. Patient states that ten weeks ago he was seized with pleuro-pneumonia of the left side that was followed by a purulent effusion. An incision was made on the fourteenth day and a large quantity of pus evacuated. The drainage-tube was removed after two weeks, but because of a reaccumulation was replaced five weeks ago. The discharge is slight, but requires two dressings daily. Temperature and pulse have been normal for two weeks. Present condition: A well developed young man with a fistulous operation in left seventh intercostal space to the outer side of the scapular angle. The drainage-tube, six inches long, leads into a cavtiy which holds a little over three ounces.

Physical examination shows normal resonance and vesicular breathing as low as the fourth rib in the line of the fistula. Below this level, dullness and very faint respiratory sounds Patient being on his way north for the summer, was advised to return for operation in the fall.

Operation Jewish Hospital, November 7, 1901. Condition of patient unchanged. Long incision in line of fistula with the cut surrounding, but not passing through it. Subperiosteal resection of five inches of the sixth and seventh ribs. Through the incision of the soft parts a cavity lined by a dense membrane was opened. Its floor was readily inspected and found just within reach of the finger-tip. An incision was made through the membrane down to the lung with a view to decortication. Owing to the depth of the surface and the density of the membrane this was impracticable. Noticing that the incision widened under observation a second one was made, then a third and a fourth. These were crossed by other incisions and one was gradually made along the groove of reflection of the thickened pleura from the lung to the parietal wall. The lung expanded visibly from the moment the first cut was made through the thickened pleura. As much as possible of the thickened costal pleura was excised. Light packing with iodoform gauze. The patient's temperature rose rather sharply for four days after the operation and resumed the normal by the end of the tenth day. He left the hospital December 4 with the wound nearly closed. By the first of January the wound had closed entirely without leaving any deformity, and the breathing-sounds at the site of operation were normal. There has been no recurrence.

Case II.—Frank T., aged 20, dental student; admitted to Cincinnati Hospital, April 22, 1900, for a stab wound of the abdomen. In the eighth intercostal space in the line of the anterior axillary fold there is a punctured wound apparently made with the blade of a pocket-knife. The patient is very much shocked and vomits blood. Immediate laparotomy by an incision along the left costal border reveals much blood in the abdomen coming from a clean wound in the anterior wall of the stomach. The wound, which was about an inch in length, was closed by a double row of sutures. The posterior wall of the stomach was not injured. Immediately after the operation the patient was removed to a private room in the hospital. Two weeks after the injury, when the patient seemed about recovered, there developed a left-sided pleurisy with great dyspnœa, displacement of the heart to the right side of the sternum, and grave general symptoms of sepsis. On the fifth day after the inception of this complication, drainage was established by the resection of an inch or more of the sixth rib. Fully a quart of pus with many shreds of lymph and clotted blood was discharged. The lung was found greatly retracted, and expanded but little from the relief of tension. Cultures showed the infection to be of the streptococcus type.

While the operation was followed by some improvement in breathing and the return of the heart to its normal place, the pneumothorax did not seem to decrease. The fever continued high during fully two weeks, when a counter opening was made with a resection of an inch or more of the seventh rib behind the posterior axillary line. This more efficient drainage caused some improvement, but it failed after four weeks' faithful trial, with frequent irrigations, to either do away with the high temperature or reduce the size of the cavity. The only breath-sounds faintly audible on the left side were heard behind on a level with the scapular spine. Therefore, multiple rib resection with removal of the thickened costal pleura was determined.

Operation, June 20, 1900. Resection through three long incisions of the fifth, sixth, seventh, eighth, and ninth ribs. The pieces of the ribs resected decreased in length from below upwards. From the inner surfaces of the musculocutaneous bridges left by the incisions the thickened pleura was scraped away. The pulmonary pleura was freely incised by gridironing incisions, and a marked expansion of the lung was immediately noticeable. The upper portion of the empyemic cavity could not be reached, but because of the weakened condition of the patient further operation was refrained from. The patient bore the operation well and improved rapidly. Three weeks later a fifth operation was performed on him. Portions of the second, third and fourth ribs were resected, and the costal pulmonary pleura treated as before. After six months' stay in the hospital he returned September 22 to his home in Hillsdale, Mich., where under the care of Dr. Sawyer complete recovery ensued. I saw the patient two years after the operation. He was in perfect health. There was relatively little sinking in of the chest-wall, although the defect in the bony thorax is nearly ten inches in height and one and one-half to five inches in width. There is no apparent regeneration of the ribs.

CASE III.—Mrs. G. B. S., widow, aged 30. Entered Good Samaritan Hospital May 22, 1903. Family history negative. Husband died of tuberculosis in Colorado three years ago. About one year after his death the patient was seized with severe pains in the right side of the chest and right shoulder, and began to cough. This condition continued for two months, with evening exacerbations of temperature. Ten weeks after the beginning of her illness thirty-five ounces of pus were removed by aspiration. Three days later the temperature rose to 104 in the evening, and continued so for four weeks, when an incision for drainage was made. The wound has discharged for over twenty months.

Present condition: The patient is confined to her bed most of the time and is very anæmic. Pulse always rapid and small. Evening temperature ranging between 100 and 101. There is some cough but no expectoration. The right side of the chest is very much retracted and immobile. The lower intercostal spaces are very narrowed. In the sixth space in the axillary line there is a small fistula with rigid and indurated margins. The probe passes upwards and inwards for a distance of eight inches. There is a cavity here which holds about thirty ounces; any attempt to force more into it causes violent coughing. Vesicular breathing suspended over the front and side of the chest below the fourth rib. It is very faintly heard above. Sputum examination negative. Diagnosis: Chronic empyema.

Operation May 25, 1903. Subperiosteal resection through three incisions of the fifth, sixth, seventh, and eighth ribs. The overlapping of the ribs made the resection somewhat difficult, although this part of the operation was very much facilitated by Doyen's ring-shaped costal periostotome. The diaphragm covered by a dense membrane projected far into the chest cavity, and the greatly retracted lung was freely exposed in the depth of the large wound. The thickened parietal pleura was easily dissected away. The adventitious membrane over the diaphragm was easily incised and the incision widened somewhat. Free discission of the pulmonary pleura, as in the previous cases. The wound was loosely packed with tampons of iodoform gauze, the ends of which were made to project through the incisions in the soft parts. The patient promptly recovered from the operation, and was enabled to return to her home, with a fistula leading into the upper portion of the empyema cavity.

Second operation, October 13, 1903. The patient now presents the appearance of perfect health. There is a fistula some five inches in depth in the line of the upper incision, made at the previous operation. Resection of the second, third and fourth ribs, with treatment of the pleura, as in the previous operations. The patient left the hospital after three weeks with the wounds practically closed. She presented herself for examination eighteen months after the second operation. She is in perfect health. There is very little deformity of the chest-wall nor is there any deflection of the spinal column. The respiratory expansions are almost as great as on the sound side.

CASE IV.—Nicholas M., aged 34. Admitted to Cincinnati Hospital October 15, 1904. Family history negative. Was brought into the hospital with a penetrating wound of the chest. One inch to the right of the twelfth dorsal spine there is an incised wound about one inch in length, apparently non-penetrating. Two inches to the right and between the tenth and eleventh ribs there is a second incised wound about an inch in length, which is penetrating. Urine analysis negative. Wounds are dressed aseptically after the custom of the hospital October 16, temperature somewhat elevated. Pulse 100 and a fair tension; respiration increased to 36 per minute. There is pain on the right side of the chest on breathing.

Physical examination shows dry pleuritic rub in the axilla and around posterior wound. Was ordered $^1/_{40}$ grain of strychnia every three hours, and purgation by calomel and enema. Ice-bags were ordered to abdomen and chest. October 17 flatness over whole right side of the chest, with absence of breath-sounds posteriorly and in axilla. Breath-sounds exaggerated anteriorly. Pain over the right side of chest on breathing. Respiration shallow and labored. Temperature 101. When the dressing was changed a quantity of dark and infected blood escaped from the upper wound with each respiration and especially on coughing. There escaped altogether thirty-four ounces from the pleural cavity.

Under ether anæsthesia drainage was established. The patient's condition, while it improved somewhat, was not materially changed as to the intrathoracic condition. There had been developed an empyema with retraction of the lung. Temperature ranged in the course of two weeks between 99 and 104.

Operation December 4, 1904, under ether anæsthesia. Schede resection of right chest-wall with resection of five ribs and the removal of the thickened parietal pleura. Discission of the pulmonary pleura with distinct widening of the incisions visible during expirations. Wound packed with gauze. From this day on the highest temperature fell to 102. In order to complete the obliteration of the empyemic cavity a second resection was made on December 29, when three ribs were resected. With the expansion of the lung now following the discission, the cavity was completely obliterated. From this time on the patient recovered his strength. His weight rose from 97 pounds to 110 pounds. He was discharged on April 27, since which time the wound has closed permanently. He is again at his usual work of driving a beer-wagon, doing all the hard labor that may be required in the discharge of his work.

It would have been easy to increase the number of cases of empyema that have come under my observation, but I have refrained from referring to those which come in very young subjects and those of later life which are secondary to tuberculosis with or without pulmonary fistula. The prognosis in the first class is usually so good when early drainage is instituted, and in the second class often bad notwithstanding any method of treatment, that I believed it wise to mention only cases of traumatic origin and those clearly the sequel of a metapneumonic process. In looking over cases of this character in adults, it became evident at once that aspiration and even incision without rib resection is of little service. In all of these cases multiple resection should be made at an early period and before the strength of the individual has been reduced by prolonged sepsis. In the operation for chronic empyema with fistula, certain rules can be formulated, which, if followed without making every operation absolutely schematic, will be reasonably certain after one or two procedures to cause complete obliteration of the cavity with very liberal expansion of the retracted lung.

First. Every operation on the thorax for pleuritic effusions of any kind should be done with the patient upon his back or slightly resting on the sound side.

Second. An incision should be made above the fistulous opening and a piece of one of two ribs removed in order that the cavity may be subjected to inspection and to touch.

Third. According to the size of the cavity thus determined, multiple subperiosteal rib resections are to be made either through a number of parallel incisions, through the U-shaped Schede incision, or through a trap-door incision, a method favored by the French surgeons. It matters little which of these methods be practiced, provided that the resections be ample and that the thickened parietal pleura be excised.

Fourth. Attention should then be given to the diaphragm and the pulmonary pleura. Incisions here should be made after the manner described. If the thickened pleura can be removed by decortication easily, it is perhaps preferable. If ample expansion of the lung does not ensue, an incision in the groove of reflexion of the costal and pulmonary pleura must be made.

Fifth. The condition of the patient should be carefully watched, lest too much be done at one sitting. When the cavities are large, repeated operations are necessary for the safety of the patient. In one case, which I saw with Prof. Evans, no less than eight operations were necessary to effect a complete cure.